AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (currently amended) A fuel injection system comprising:

an injector for injecting high-pressure fuel, and

a controller for determining request injection timing and a request injection quantity in response to a running condition of an internal combustion engine to controllably open or close the injector in accordance with the request injection timing and the request injection quantity, the controller further comprising:

means for determining a multisided geometry defined by an actual change in injection rate of the injector with respect to time, the multisided geometry being determined based on a current pressure of the fuel supplied to the injector and a rising injection rate of the fuel which is previously measured and stored in the controller; and

determining drive signal generation timing and drive signal termination timing of an injector control signal for the injector from the multisided geometry of the injection rate having an area corresponding to the request injection quantity.

2. (previously presented) A fuel injection system according to claim 1, wherein

the fuel injection system determines a geometry defined by a change in needle lift amount of the injector with respect to time, and converts the geometry of needle lift quantity to determine the geometry of the injection rate.

3. (currently amended) A fuel injection system comprising:

an injector for injecting high-pressure fuel, and

a controller for determining request injection timing and a request injection quantity in response to a running condition of an internal combustion engine to controllably open or close the injector in accordance with the request injection timing and the request injection quantity, the controller further comprising:

means for determining a multisided geometry defined by a change in injection rate of the injector with respect to time, the multisided geometry being determined based on a current pressure of the fuel supplied to the injector and a rising injection rate of the fuel which is previously measured and stored in the controller; and

determining drive signal generation timing and drive signal termination timing of an injector control signal for the injector from the geometry of the injection rate having an area corresponding to the request injection quantity;

wherein the fuel injection system determines a geometry defined by a change in needle lift amount of the injector with respect to time, and converts the geometry of needle lift quantity to determine the geometry of the injection rate; and

the determination of the geometry of the injection rate by converting the geometry of needle lift quantity includes

dividing an injection region into a seat aperture region in which an injection quantity is determined between a needle and a nozzle seat of the injector and an injection hole aperture region in which an injection quantity is determined in accordance with an aperture level of an injection hole of the injector,

making a linear approximation of injection flow rate against needle lift quantity characteristics in the seat aperture region for an injection rate against needle lift quantity conversion, and

making a linear approximation of injection flow rate against needle lift quantity characteristics in the injection hole aperture region for an injection rate against needle lift quantity conversion.

4. (currently amended) A fuel injection system comprising:

an injector for injecting high-pressure fuel, and

a controller for determining request injection timing and a request injection quantity in response to a running condition of an internal combustion engine to controllably open or close the injector in accordance with the request injection timing and the request injection quantity, the controller further comprising:

means for determining a geometry defined by a change in injection rate of the injector with respect to time, and

determining drive signal generation timing and drive signal termination timing of an injector control signal for the injector from the geometry of the injection rate having an area corresponding to the request injection quantity;

wherein the geometry of the injection rate is a multisided geometry drawn ~~to have conditions of a pressure at which high-pressure fuel is supplied to the injector and a specification of a discharge line of the injector~~ based on a current pressure of the fuel supplied to the injector and a rising injection rate of the fuel which is previously measured and stored in the controller.

5. (currently amended) A fuel injection system according to claim 1, wherein the

multisided geometry of the injection rate is ~~drawn~~ determined in terms of

~~a~~ said rising injection rate, said rising injection rate being provided when ~~the~~ a needle rises in the injector,

a falling injection rate provided when the needle falls in the injector, and

a maximum injection rate applied when the rising injection rate reaches a maximum injection rate.

6. (currently amended) A fuel injection system according to claim 1, wherein

the drive signal generation timing of the injector control signal for the injector is determined to be at a valve opening pressure achieving time before a start point of formation in time of the injection rate against time geometry, the valve opening pressure achieving time being measured from a valve opening command being given to the injector to an actual start of fuel injection by the injector.

7. (currently amended) A fuel injection system according to claim 1, wherein

the fuel injection system determines

[[the]]a valve opening pressure achieving time measured from [[the]]a start point of formation in time of the injection rate against time geometry until [[the]]a valve opening command is provided to the injector to actually start injecting fuel,

a valve closing pressure achieving time measured from a valve closing command being given to the injector until an injection rate actually starts falling, and

a needle rise time measured from the start point of formation in time of the injection rate against time geometry until a control chamber of the injector reaches a valve closing pressure, and

a duration measured from the drive signal generation timing to the drive signal termination timing of the injector is determined by Tds+Tqr-Tde1.

8. (currently amended) A fuel injection system according to claim 7, wherein the needle rise time is determined in terms of

the request injection quantity,

the rising injection rate, the rising injection rate being provided when the needle rises in the injector, and

[[the]]a falling injection rate provided when the needle lowers in the injector.

9. (currently amended) A fuel injection system comprising:

an injector for injecting high-pressure fuel, and

a controller for determining request injection timing and a request injection quantity in response to a running condition of an internal combustion engine to controllably open or close the injector in accordance with the request injection timing and the request injection quantity, the controller further comprising:

means for determining a multisided geometry defined by a change in injection rate of the injector with respect to time, the multisided geometry being determined based on a current pressure of the fuel supplied to the injector and a rising injection rate of the fuel which is previously measured and stored in the controller; and

determining drive signal generation timing and drive signal termination timing of an injector control signal for the injector from the geometry of the injection rate having an area corresponding to the request injection quantity;

wherein the drive signal generation timing of the injector control signal for the injector is determined to be at a valve opening pressure achieving time before a start point of formation in time of the injection rate against time geometry, the valve opening pressure achieving time being measured from a valve opening command being given to the injector to an actual start of fuel injection by the injector; and

the valve opening pressure achieving time is determined by a function of a pressure of the high-pressure fuel supplied to the injector and multiple-injection intervals at which fuel is injected separately in a multiple number of times in once cycle.

10. (currently amended) A fuel injection system according to claim 1, wherein to correct for a variation in injection quantity, the controller employs at least one of the following injection parameters as an adjustment parameter, and stores the adjustment parameter as a learned value to reflect the value on a next injection, the injection parameters including

[[the]]a valve opening pressure achieving time measured from the start point of formation in time of the injection rate against time geometry until the valve opening command is provided to the injector to actually start injecting fuel,

the rising injection rate, the rising injection rate being provided when [[the]]a needle rises in the injector,

[[the]]a falling injection rate provided when the needle lowers in the injector,

[[the]]a maximum injection rate applied when the rising injection rate reaches a maximum injection rate, [[the]]a valve closing pressure achieving time measured from a valve closing command being given to the injector until an injection rate actually starts falling,

[[the]]a needle rise time measured from [[the]]a start point of formation in time of the injection rate against time geometry until the control chamber of the injector reaches a valve closing pressure, and

a duration measured from the drive signal generation timing to the drive signal termination timing of the injector.

11. (original) A fuel injection system according to claim 10, wherein to correct for a variation in injection quantity, the controller

employs two or more of the injection parameters as adjustment parameters and weights the adjustment parameters to correct for the variation in injection quantity, and

stores the respective adjustment parameters as a learned value to reflect the value on a next injection.

12. (original) A fuel injection system according to claim 1, wherein to correct for a variation in injection quantity, the controller estimates the variation in injection quantity as being caused by a change in a parameter of a predetermined portion defining a specification of the injector to employ the parameter of the predetermined portion as an adjustment parameter and store the adjustment parameter as a learned value to reflect the value on a next injection.

13. (currently amended) A method of controlling a fuel injection system utilizing

an injector for injecting high-pressure fuel, the method comprising:

providing a controller for determining request injection timing and a request injection quantity in response to a running condition of an internal combustion engine;

controllably opening or closing the injector in accordance with the request injection timing and the request injection quantity;

determining a multisided geometry defined by an actual change in injection rate of the injector with respect to time, the multisided geometry being determined based on a current pressure of the fuel supplied to the injector and a rising injection rate of the fuel which is previously measured and stored in the controller; and

determining a drive signal generation timing and a drive signal termination timing of an injector control signal for the injector from the multisided geometry of the injection rate having an area corresponding to the request injection quantity.

14. (previously presented) The method of controlling a fuel injection system according to claim 13, the method further comprising:

determining a geometry defined by a change in needle lift amount of the injector with respect to time; and

converting the geometry of needle lift amount to determine the multisided geometry of the injection rate.

15. (currently amended) A method of controlling a fuel injection system utilizing an injector for injecting high-pressure fuel, the method comprising:

providing a controller for determining request injection timing and a request injection quantity in response to a running condition of an internal combustion engine;

controllably opening or closing the injector in accordance with the request injection timing and the request injection quantity;

determining a multisided geometry defined by a change in injection rate of the injector with respect to time, the multisided geometry being determined based on a current pressure of the fuel supplied to the injector and a rising injection rate of the fuel which is previously measured and stored in the controller; and

determining a drive signal generation timing and a drive signal termination timing of an injector control signal for the injector from the geometry of the injection rate having an area corresponding to the request injection quantity;

determining a geometry defined by a change in needle lift amount of the injector with respect to time; and

converting the geometry of needle lift amount to determine the geometry of the injection rate;

determining the geometry of the injection rate by converting the geometry of needle lift amount by:

dividing an injection region into a seat aperture region in which an injection quantity is determined between a needle and a nozzle seat of the injector and an injection hole aperture region in which an injection quantity is determined in accordance with an aperture level of an injection hole of the injector;

making a linear approximation of injection flow rate against needle lift amount characteristics in the seat aperture region for an injection rate against needle lift amount conversion; and making a linear approximation of injection flow rate against needle lift amount characteristics in the injection hole aperture region for an injection rate against needle lift amount conversion.

16. (currently amended) A method of controlling a fuel injection system utilizing an injector for injecting high-pressure fuel, the method comprising:

providing a controller for determining request injection timing and a request injection quantity in response to a running condition of an internal combustion engine;

controllably opening or closing the injector in accordance with the request injection timing and the request injection quantity;

determining a multisided geometry defined by a change in injection rate of the injector with respect to time, the multisided geometry being determined by a current pressure of the fuel supplied to the injector and a rising injection rate of the fuel which is previously measured and stored in the controller;;

determining a drive signal generation timing and a drive signal termination timing of an injector control signal for the injector from the geometry of the injection rate having an area corresponding to the request injection quantity; and

developing the geometry of the injection rate in accordance with conditions of a pressure at which high-pressure fuel is supplied to the injector and a specification of a discharge line of the injector.

17. (currently amended) The method of controlling a fuel injection system according to claim 13, the method further comprising:

developing the multisided geometry of the injection rate in accordance with ~~a~~ said rising injection rate, said rising injection rate being provided when [[the]]a needle rises in the injector,

a falling injection rate provided when the needle falls in the injector, and

a maximum injection rate applied when the rising injection rate reaches a maximum injection rate.

18. (currently amended) The method of controlling a fuel injection system according to claim 13, further comprising:

determining the drive signal generation timing of the injector control signal for the injector to be at a valve opening pressure achieving time before a start point of formation in time of the injection rate against time geometry; and

measuring the valve opening pressure achieving time from a valve opening command being given to the injector to an actual start of fuel injection by the injector.

19. (currently amended) The method of controlling a fuel injection system according to claim 13, the method further comprising:

determining [[the]]a valve opening pressure achieving time measured from [[the]]a start point of formation in time of the injection rate against time geometry until [[the]]a valve opening command is provided to the injector to actually start injecting fuel;

determining a valve closing pressure achieving time measured from a valve closing command being given to the injector until an injection rate actually starts falling;

determining a needle rise time measured from the start point of formation in time of the injection rate against time geometry until a control chamber of the injector reaches a valve closing pressure; and

determining a duration measured from the drive signal generation timing to the drive signal termination timing of the injector by Tds+Tqr-Tde1.

20. (currently amended) The method of controlling a fuel injection system according to claim 19, further comprising:

determining the needle rise time in terms of:

~~the~~ a request injection amount,

the rising injection rate, the rising injection rate being provided when [[the]]a needle rises in the injector, and

~~the~~ a falling injection rate provided when the needle falls in the injector.